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Gear drive for an electric motor

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ABSTRACT

A gear drive assembly (5) for use with an electric motor (2) for actuation of a flap of a heater, ventilator and air-conditioning system. The drive assembly includes an axle (4) for snap-fit engagement in associated bearings (6,7). The axle is provided with radial stabiliser structure (16) which preferably also includes circumferentially spaced blades (21) projecting therefrom for interaction with a photoelectric sensor device (22).

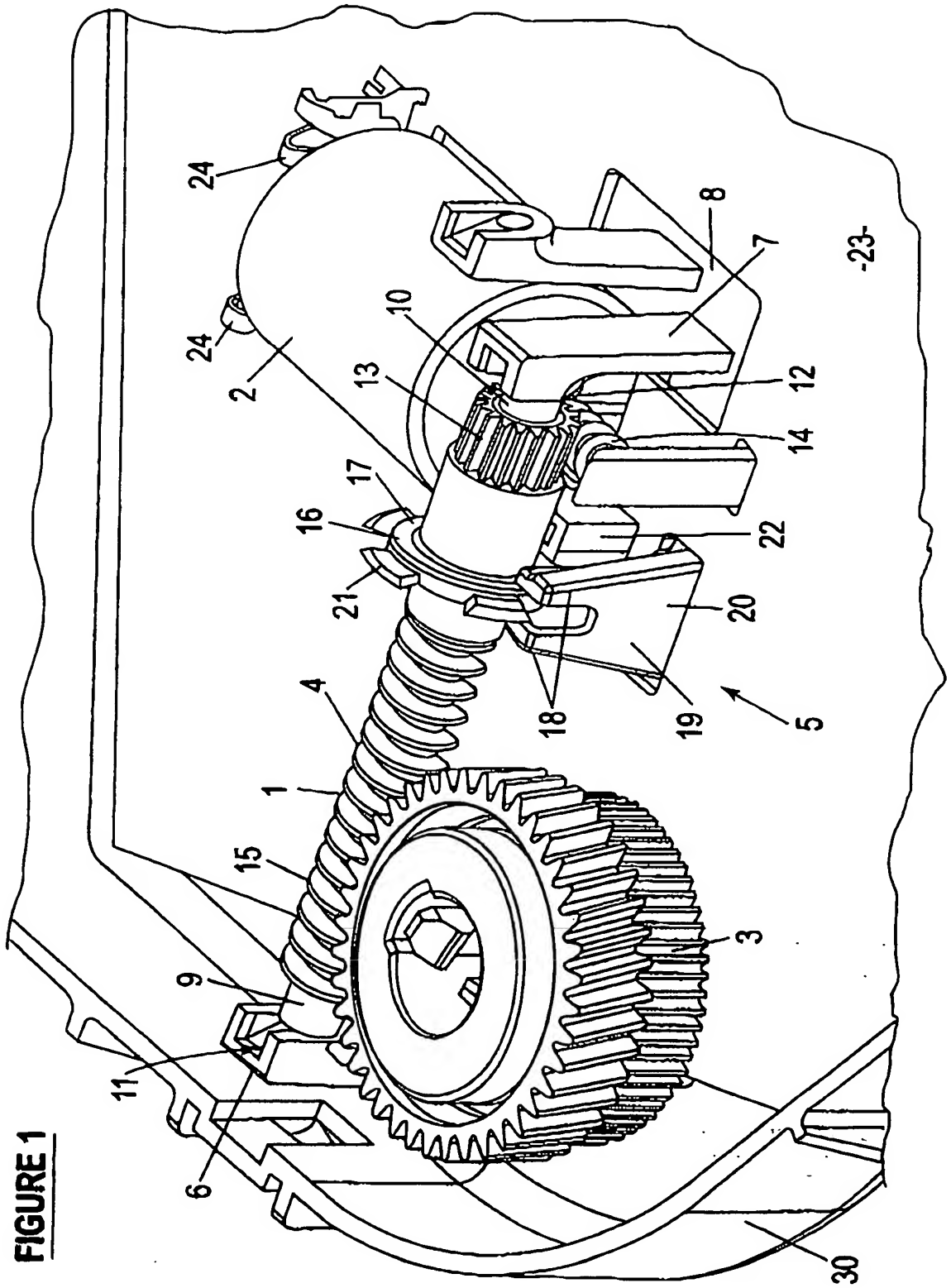

FIGURE 1

Regulation 3.2

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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

(ORIGINAL)

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Invention Title: **"Gear drive for an electric motor"**

The following statement is a full description of this invention, including the best method of performing it known to us:

GEAR DRIVE FOR AN ELECTRIC MOTOR

Field of the Invention

The present invention relates to a gear drive assembly for use with an electric motor and, more generally, to an axle of the drive assembly.

Background of the Invention

It is known to provide a heater, ventilator and air-conditioning system in a vehicle. Such a system utilises flap actuators which are controlled from a central controller to drive flaps via associated electric motors and gears. The flap actuators are generally individually constructed and separately housed for wiring to the central controller.

Object of the Invention

It is an object of the invention to provide a gear drive assembly and axle which allow for a more modular and simplified construction of the flap actuators.

Summary of the Invention

In accordance with the invention, there is provided a gear drive assembly for use with an electric motor, including two support bearings and an axle mounted to the bearings, to be driven by the motor, wherein the bearings are constructed to allow for relative movement therebetween to receive the axle in snap-fit engagement, characterised in that:

the axle includes a radial stabiliser structure; and

the assembly further includes a stabiliser fitting fixed substantially rigidly relative to the bearings for cooperation with the structure during rotation of the axle, to restrict axial displacement of the axle during operation of the motor.

Preferably, the stabiliser structure includes a disc. More preferably, the axle and

disc are unitarily moulded.

Preferably, the fitting includes a main body with two arms extending either side of the structure.

Preferably, the bearings and fitting are mounted to a base portion of a housing which includes a cover to which a second fitting of the assembly is attached, to cooperate with the first fitting to capture the structure therebetween when the cover is fitted to the housing.

Preferably, the axle includes circumferentially spaced blades and the assembly further includes a photoelectric sensor device for sensing the relative positioning of the blades to determine the associated rotational position of the axle.

Preferably, the blades project from the stabiliser structure. More preferably, the blades are integrally moulded with the stabiliser structure.

In another aspect, there is provided a method for controlling a motor, for actuation of a flap of a heater, ventilator and air-conditioning system, characterised in that:

the motor drives the flap via a gear drive assembly, as described above; and

the method includes monitoring the rotational position of the axle using the sensing device, storing end positions of the flap in a memory and controlling the motor to position the flap at a desired location by reference to the rotational position of the axle.

Preferably, the end positions represent mechanical limits of the flap and the method includes stopping the motor before the flap reaches the end positions.

In another aspect, there is provided an axle for use in the above assembly, the axle including a radial stabiliser structure.

Preferably, the stabiliser structure includes a disc. More preferably, the disc is unitarily moulded with the axle.

Preferably, the axle includes circumferentially space blades.

Preferably, the blades project from the stabiliser structure. More preferably, the blades are integrally moulded with the stabiliser structure.

Brief Description of the Drawings

The invention is more fully described, by way of example only, with reference to the drawing, in which:

Figure 1 is perspective view of a gear drive of the present invention.

Detailed Description

A gear drive 1 is shown in Figure 1 as providing driving engagement between a motor 2 and a gear 3. The gear drive comprises an axle 4 which forms part of a gear drive assembly 5. The assembly includes two support bearings 6, 7 which are mounted to a base portion 8 of a housing 30 to receive respective ends 9, 10 of the axle 4 in associated recesses 11, 12. The bearings 6, 7 are constructed, such as from resilient plastics material, to allow for relative movement therebetween so that the axle can be received in snap-fit engagement therebetween, into the recesses 11, 12.

When engaged between the bearings 6, 7, the axle is arranged so that teeth 13 can engage with worm drive 14 of the motor 2 to cause rotation of the axle 4 and transmission of that rotational movement to the gear 3 via worm gear 15, extending along the length of the axle 4. Since the bearings 6, 7 are constructed for relative movement therebetween, driving engagement between the axle 4, the gear 3 and motor 2 may result in moments being applied to the axle which could lead to the axle 4 being dislodged from the bearings. To avoid that problem, the axle is provided with a radial stabiliser structure 16 which is shown in the form of a disc 17, integrally moulded with the remainder of the axle 4. The disc 17 is received between arms 18 of a stabiliser fitting 19 which is mounted to the base portion 8 via a main body 20. The fitting 19 serves to restrict axial displacement of the axle 4 during operation of the motor. A

corresponding second fitting may be provided on a cover (not shown) which is fitted over the housing 30, to fully capture the structure 16 therebetween.

The axle 4 may also be provided with circumferentially spaced blades 21 which are shown as being integrally formed and projecting radially from the structure 16, although the blades may, of course, be provided at any other suitable location along the length of the axle 4. The blades interact with a photoelectric sensing device 22 of the assembly which may be arranged on a printed circuit board 23 overlying the base portion 8. The sensor device 22 serves to sense the number of times the blades 21 are rotated in front of it to determine the associated rotational position of the axle 4.

As may be appreciated then, the gear drive 1 may be quickly and easily assembled by having the bearings 6, 7 and fitting 19 pre-moulded with the base portion 8, for snap fitting to the board 23. The sensor device 22 and associated components such as connectors 24, for electrically connecting the motor 2 to the board, can then be soldered in place. The motor 2 may then be appropriately positioned and the axle 4 simply snap fitted into the bearings 6, 7 to complete the assembly 5, to provide a neat, unitary construction. The printed circuit board 24 also allows the gear drive 1 and motor 2 to be readily integrated, with other like gear drives and motors, on the same board within the housing 30, for convenient control by a microprocessor.

In that regard, the microprocessor may be used to control the motor for positioning a flap (not shown), driven by the gear 3, in a heater, ventilator and air-conditioning system (HAVC) by monitoring output from the sensor 22. The microprocessor (P) may also have a learn routine to learn Zero and Max end positions of the flap. The routine can be executed during factory testing and after a uP reset. It can include the switching off of fans and turning the motor to its uttermost left and right positions in two similar processes. During each process the routine waits for the flap to reach its mechanical limit and switches off the motor. For this purpose the duration and number of light pulses detected by the sensor device 22, as the blades 21 pass in front thereof, may be measured so as to execute a time out or motor stop function, as

appropriate. A plausibility check and error recovery / propagation routine may also be included in case the HVAC jams.

The invention has been described by way of non-limiting example only and many modifications and variations may be made thereto without departing from the spirit and scope of the invention described.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A gear drive assembly (5) for use with an electric motor (2), including two support bearings (6,7) and an axle (4) mounted to the bearings (6,7), to be driven by the motor (2), wherein the bearings (6,7) are constructed to allow for relative movement therebetween to receive the axle (4) in snap-fit engagement, characterised in that:

the axle includes a radial stabiliser structure (16); and

the assembly (15) further includes a stabiliser fitting (19) fixed substantially rigidly relative to the bearings (6,7) for cooperation with the structure (16) during rotation of the axle (4), to restrict axial displacement of the axle (4) during operation of the motor (2).

2. A gear drive assembly (5), as claimed in claim 1, wherein the stabiliser structure (16) includes an annular disc (17).

3. A gear drive assembly (5) as claimed in claim 2, wherein the disc (17) is unitarily moulded with the axle (4).

4. A gear drive assembly (5) as claimed in any one of claims 1 to 3, wherein the fitting (19) includes a main body (20) with two arms (18) extending either side of the structure (16).

5. A gear drive assembly (5) as claimed in any one of claims 1 to 4, wherein the bearings (6,7) and fitting (19) are mounted to a base portion (8) of a housing (30) which includes a cover to which a second fitting of the assembly (5) is attached, to cooperate with the first fitting (19) to capture the structure (16) therebetween when the cover is fitted to the housing (30).

6. A gear drive assembly (5) as claimed in any one of claims 1 to 5, wherein the axle (4) includes circumferentially spaced blades (21) and the assembly (5) further includes a photoelectric sensor device (22) for sensing relative positioning of the blades (21) to determine the associated rotational position of the axle.

7. A gear drive assembly as claimed in claim 6, wherein the blades (21) project from

the stabiliser structure (16).

8. A gear drive assembly as claimed in claim 7, wherein the blades (21) are integrally moulded with the stabiliser structure (16).

9. A method for controlling a motor (2), for actuation of a flap of a heater, ventilator and air-conditioning system, characterised in that:

the motor (2) drives the flap via a gear drive assembly (5), as claimed in any one of claims 6 to 8; and

the method includes monitoring the rotational position of the axle (4) using the sensing device (22), storing end positions of the flap in a memory and controlling the motor (2) to position the flap at a desired location by reference to the rotational position of the axle (4).

10. The method of claim 9, wherein the end positions represent mechanical limits of the flap and the method includes stopping the motor (2) before the flap reaches the end positions.

11. An axle (4) for use in a gear drive assembly (5) as claimed in any one of claims 1 to 8, characterised in that:

the axle (4) includes a radial stabiliser structure (16).

12. An axle (4) as claimed in claim 11, wherein the stabiliser structure (16) includes a disc (17).

13. An axle (4) as claimed in claim 12, wherein the disc (17) is unitarily moulded with the axle (4).

14. An axle (4) as claimed in any one of claims 11 to 13, wherein the axle (4) includes circumferentially space blades (21).

15. An axle (4) as claimed in claim 14, wherein the blades project from the stabiliser structure (16).

16. An axle (4) as claimed in claim 14 or 15, wherein the blades (21) are integrally moulded with the stabiliser structure (16).

DATED this 12th day of December, 2000

Robert Bosch GmbH

By **DAVIES COLLISON CAVE**
Patent Attorneys for the applicant

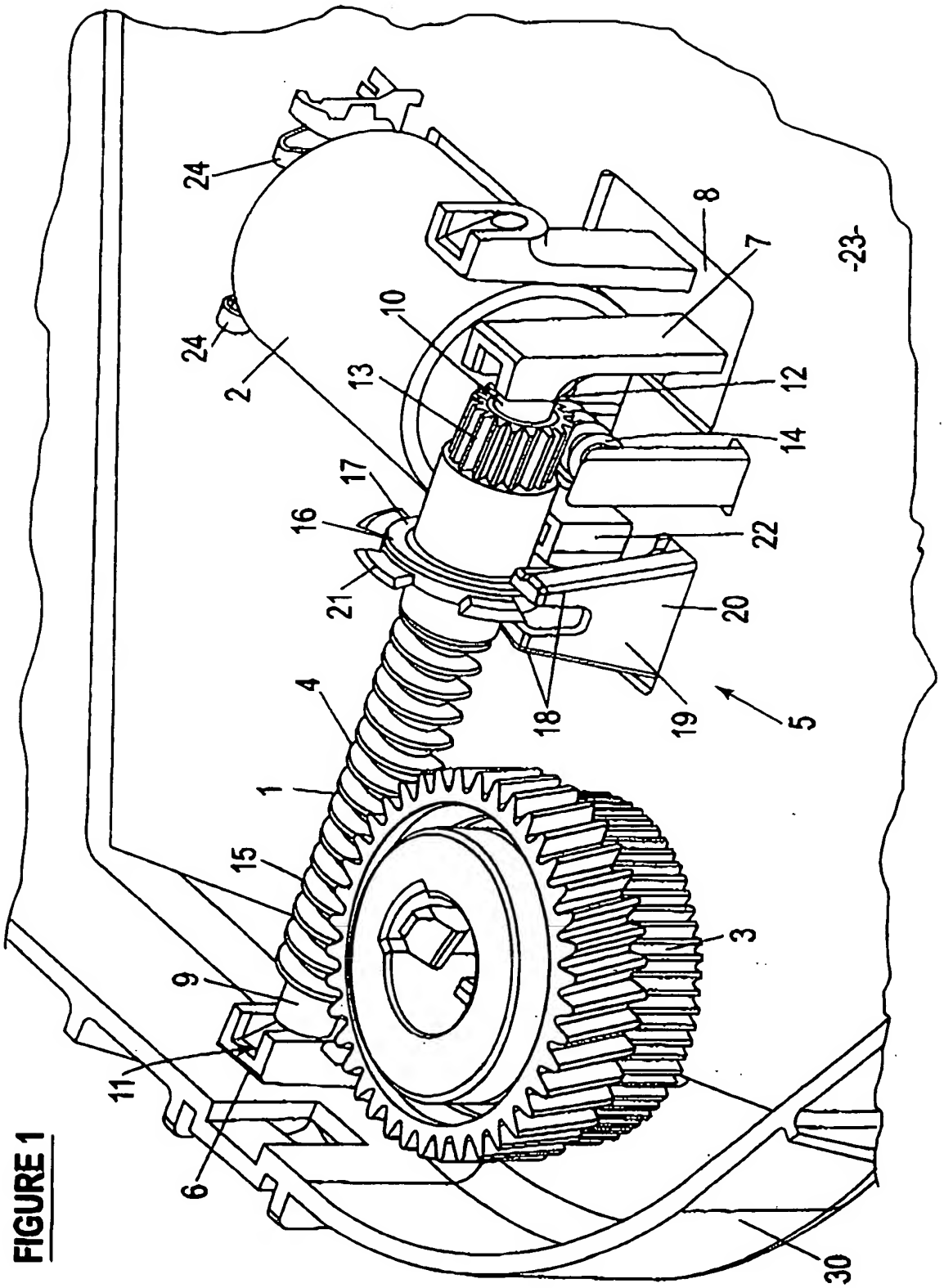

FIGURE 1